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**INTELLIGENT CALL PROCESSING
PLATFORM FOR HOME TELEPHONE SYSTEM**

TECHNICAL FIELD

The present invention relates generally to a centralized
5 control system for a group of telephones located, for example,
in a home, and more particularly to the use of voice commands
in conjunction with voice recognition and speaker verification
techniques to provide a variety of telephone services for the
users of such telephones.

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BACKGROUND OF THE INVENTION

Conventional telephone systems for the home or office
include one or more telephone sets normally connected to a
telephone switching center (i.e., a central office, PBX, or
15 key telephone system) through a cable. With the advent of
economical and reliable digital technology, recently it has
been possible to provide enhanced functionality to the typical
telephone. Thus, many companies are now manufacturing and
marketing such devices as videophones, display phones, digital
20 answering machines, screen-based, menu-driven phones and the
like. These devices facilitate provision of various caller
services including call forwarding, call waiting, voice store
and forward, billing assistance, caller identification, and
other functions. Although such devices provide significant
25 operational capabilities as compared to conventional telephone

sets, there are a myriad of service offerings and the various types of equipment have yet to be successfully integrated into a single system that can be conveniently or selectively controlled by the telephone users.

5 Thus, there remains a need to provide an intelligent call processing apparatus for interfacing to, to be controlled through, and to control a plurality of telephones located in a defined area, such as a home, to facilitate enhanced telephone service offerings.

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BRIEF SUMMARY OF THE INVENTION

It is an object of the present invention to provide a centralized control system for one or a plurality of telephones in a home or other similar environment wherein 15 preferably voice commands are used to control access to and operation of one or more telephone service offerings.

It is a further feature of the present invention to implement a voice recognition and-or speaker verification control system in conjunction with an intelligent call processing platform interconnected to a plurality of telephone sets to thereby provide feature control of one or more 20 telephone service offerings.

It is still another feature of the invention to provide an intelligent call processor connectable to telephone sets in 25 a home or office facility to provide monitoring of incoming

telephone calls to facilitate preferably voice control over one or more enhanced caller services, for example, caller identification, call-blocking, call store and forward, or smart ringing.

5 It is another object to provide a call processing platform that facilitates a central implementation of a number of ancillary services for all telephones in the home, even if such telephones are conventional handset devices.

10 It is a still further object of the invention to describe an intelligent processing apparatus that interfaces to telephone sets to monitor an incoming telephone line, whether that line is a conventional wire line, coaxial cable, or wireless connection. The apparatus is preferably voice-activated and controlled to provide one or more call 15 services at the request of selective persons in the home but may also be operated via DTMF digits.

15 It is yet another object of the present invention to provide an apparatus having on-line monitoring capabilities for the selective offering and providing of various ancillary 20 services under the voice control of one of the parties to the call.

25 The foregoing has outlined some of the more pertinent objects of the present invention. These objects should be construed to be merely illustrative of some of the more prominent features and applications of the invention. Many

other beneficial results can be attained by applying the disclosed invention in a different manner or modifying the invention as will be described. Accordingly, other objects and a fuller understanding of the invention may be had by 5 referring to the following Detailed Description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present 10 invention and the advantages thereof, reference should be made to the following Detailed Description taken in connection with the accompanying drawings in which:

15 FIGURE 1 is a block diagram of a telephone system incorporating the basic version of the intelligent call processing platform of the present invention; and

FIGURE 2 is a block diagram of a telephone system incorporating the enhanced version of the intelligent call processing platform of FIGURE 1;

20 FIGURE 3 is a detailed system diagram showing the components of the intelligent call processing platform of FIGURE 1 and FIGURE 2;

FIGURE 4 is a flow chart of the executive routine from which all other routines are accessed;

25 FIGURE 5 is a flow chart of the incoming call handler routine for directing and/or controlling incoming telephone calls;

FIGURE 6 is a flow chart of the routine for playing messages to incoming calls;

FIGURE 7 is a flow chart of the routine for recording messages from incoming calls;

5 FIGURE 8 is a flow chart showing the originating call/command handler routine which is accessed by the executive routine of FIGURE 4 for defining operations that occur when the handset of a connected telephone has been lifted;

10 FIGURE 9 is a flow chart of the routine for acquiring spoken commands;

FIGURE 10 is a flow chart of the spoken digit collection routine used to obtain spoken numeric sequences;

15 FIGURE 11 is a flow chart showing the routine for providing speed dialing capabilities from spoken key words;

FIGURE 12 is a flow chart of the routine for providing speed dialing capabilities from speaker-dependent words stored by the user and associated with each telephone number or numeric sequence to be dialed;

20 FIGURE 13 is a flow chart showing the routine for programming speed dial numbers using key words;

FIGURE 14 is a flow chart showing the routine for programming speed dial numbers using numeric memory locations;

25 FIGURE 15 is a flow chart showing the routine for programming speed dial numbers using speaker-dependent directory words;

FIGURE 16 is a flow chart showing the routine for changing programming parameters through both local and remote access;

FIGURE 17 is a flow chart of the routine for playing back 5 messages from callers; and

FIGURE 18 is a flow chart of the peripheral control routine used to operate lights, thermostats, alarm systems, televisions, stereos, or other electronic devices.

Similar reference characters refer to similar parts 10 throughout the several views of the drawings.

DETAILED DESCRIPTION

As seen in FIGURE 1, the intelligent call processing platform 2 of the present invention is preferably implemented in a home which typically includes one or a plurality of 15 telephone sets 4a...4n. FIGURE 2 shows an enhanced version of FIGURE 1 and allows for additional features. The core system components shown in FIGURE 3 for both FIGURE 1 and FIGURE 2 are the same with the exception that the system depicted in 20 FIGURE 2 is installed in a personal computer or any processor controlled system and utilizes the optional PC interface 36. Although the present invention is shown in the environment of 25 a home, it should be appreciated that the intelligent call processor is likewise useful whenever it is desired to provide a number of telephone sets with certain enhanced features as

will be seen. Thus, the example of an intelligent home system is merely exemplary.

The intelligent call platform is preferably connected between a switching system or switching central office and the 5 telephone sets 4. As seen in FIGURE 1 or FIGURE 2, the platform is connected to all of the telephone sets, although this is not a requirement of the system. The method of connection between the platform and telephone sets may be serial or parallel. The switching office is typically a local 10 telephone operating company central office operating within a so-called local access and transport area (LATA) although this is not the only configuration in the invention. When long distance service is required, the call is usually transmitted through the operating company central office to a point of 15 termination in the originating LATA at which it is picked up by a common carrier and passed by that carrier on to a termination point in a local or distant LATA. Such operation is conventional in the art. Moreover, while the physical 20 connections shown in FIGURE 1 and FIGURE 2 are typical it is envisioned that the home be connected to the switching office alternatively via a coaxial cable, fiber optic cable, wireless link or other suitable connection. Such alternative communication channels are also known.

The intelligent processing platform shown in the system 25 diagram of FIGURE 3 includes a voice recognition algorithm as

well as a speaker verification algorithm to facilitate voice-controlled access and control over various service offerings. The platform may alternatively include DTMF digit recognition algorithms to provide access and control over the service offerings. The platform includes a digital signal processor (DSP) 42 for controlling the overall operation of the system. The DSP includes data, address, and control buses represented in FIGURE 3. As seen in FIGURE 2, the enhanced platform 10 may also include conventional input/output devices such as a keyboard 12 and display terminal 14 and may additionally include a mouse, microphone, speech generator, and printer. A communications interface 52 interfaces the platform to the internal telephone sets and a communications (C.O.) circuit 48 interfaces the platform to external telephone lines. If alternative communication links (such as coaxial cable) are used, the interface 48 will include additional circuitry to interface the additional signaling (such as video or the like) to the intelligent processing platform.

The platform also includes a voice and/or video store and forward capability for recording messages. Random access memory ("RAM") 32 is connected to the DSP by the address, data, and control buses for providing temporary storage of data processed thereby. Read only memory ("ROM") 28 is likewise connected to the digital processor for providing

nonvolatile operational code. ROM 34 is likewise connected to the digital processor for providing permanent storage of speaker-independent recognition tables and prestored messages for instructing the user on his/her progress when operating the system. Verification data is stored in programmable nonvolatile FLASH Memory 30. For the enhanced version, disk storage on the personal computer 10 may support control programs including the voice recognition algorithm and the voice verification algorithm as well as suitable control programs (not shown). A voice command system of this type is described in copending application Serial No. 07/523,486, filed May 15, 1990, to Hunt et al., titled "Simultaneous Speaker-Independent Voice Recognition And Verification Over A Telephone Network," assigned to the assignee of the present invention and incorporated herein by reference.

The voice recognition algorithm may be based on speaker-dependent or speaker-independent discrete, speaker-independent phonetic, connected or continuous recognition. Such techniques are known in the art. Where reduced cost is required, speaker-dependent algorithms are preferably used. A predetermined set of commands may be used in the system and/or commands may be created in a known manner. In particular, where the user desires to create special commands, the system prompts the user to speak the command a number of times while the recognizer is "trained" in

a conventional manner. A template (e.g., speech reference data) is created for each command and store in memory, and the user typically will then enter the telephone number associated with such command for later retrieval whenever the command is 5 recognized. Thus a user may create a number of special call commands, e.g., "account balance," "directory assistance," "grandma," etc., the recognition of which control the processing platform to dial a stored number and/or dialing sequence associated therewith.

10 The platform shown in FIGURE 3 also includes a speaker verification reference database stored in FLASH Memory 30 comprising speaker verification class reference data collected from users authorized to access the service offerings. In this way, the platform allows control over the service 15 offerings by selected members of the home. Thus, for example, one or more family members may enroll his or her "voice" in the speaker verification reference database and thus, as will be seen, exercise control over the ability of other members (such as children) to access certain services. Thus, certain 20 of the service offerings may be programmed to be accessible only if voice commands are both recognized and/or verified to have come from a person authorized to obtain the service. The use of speaker verification thus provides an additional level 25 of security which has numerous advantages. For example, parents may program the platform to prevent children from

making unauthorized calls since such calls will only be allowed if the voice command used to institute the call is both recognized and the speaker is authorized for the service. Additionally, the speaker verification capability 5 will provide security for remotely accessing recorded messages and will allow user specific access to the recorded messages. Recorded messages will be stored in the Flash Memory of FIGURE 3 for systems as shown in FIGURE 1, but may optionally be stored on the disk drive of the personal computer 10 of FIGURE 10 2, or any other system memory.

In a caller identification application, the database in the platform may be programmed to include one or more telephone numbers or groups of telephone numbers that the homeowner desires to block; alternatively, the database may be 15 programmed to identify those telephone numbers from which the caller desires to receive calls. Additionally, specific outgoing calls may be blocked respectively for each user. When undesirable calls are received, the platform redirects the calls to the play message routine of FIGURE 6 or the 20 record routine of FIGURE 7 to play an audio and/or video announcement message and/or to record a message for the homeowner. The calls are identified using the Caller ID number transmitted with each telephone call.

The platform is preferably accessible for each of the 25 telephones in the home (or the platform itself via the

microphone) to facilitate voice control of such functions as dialing, call forwarding, voice store and forward, smart ring, caller identification, call waiting, message playback, and the like. Incoming calls may be directed to specific telephones 5 or messaging centers using smart ring or incoming caller identification. Alternatively, the telephone systems may be accessed by push button when DTMF recognition procedures are used.

Referring now to FIGURES 4 through 18, wherein there is 10 illustrated a plurality of flow charts illustrating the operating routines enabling voice or DTMF control of a variety of telephone services through the Intelligent Call Processor Platform. FIGURE 4 illustrates the executive routine through which all calls and all command routines are accessed. The 15 system monitors at step 102 for an incoming call. When an incoming call is detected, the call is forwarded to the incoming call handler routine which will be more fully discussed with respect to FIGURE 5. When no incoming calls are detected control passes to inquiry step 104 to determine 20 if an off-hook condition exists. When no off-hook condition exists, control returns to step 102, and the executive routine continues to monitor for either an incoming call or telephone off-hook condition. If a telephone off-hook condition is detected, control passes to the originating call/command 25 handler routine described with respect to FIGURE 8.

Referring now to FIGURE 5, there is illustrated the incoming call handler routine. The incoming call handler routine directs and/or controls incoming telephone calls and assists in routing the call to the proper telephone service.

5 A test performed at step 202 determines if the smart-ring service is active for the incoming call. If so, the smart-ring table stored in FLASH MEMORY 30 is accessed at step 204 to determine the proper telephone port to signal for the incoming call. The telephone port flag corresponding to 10 the determined port is set at step 206. Once the telephone port flag is set or inquiry step 202 determines the smart-ring feature is not active, inquiry step 208 determines if the Caller I.D. function is active for the incoming call. When the Caller I.D. function is active, the Caller I.D. table is 15 checked at step 210 to determine the telephone port to signal and the identity of the caller based upon the Caller I.D. transmitted with the call. The corresponding telephone port flag is set at step 212.

After setting the correct telephone port flag or 20 determining the Caller I.D. function is not active, step 214 determines if a prerecorded message is to be played after the second or fourth ring. If such a message is to be played, the platform checks a function table and answer flag based upon 25 the Caller I.D. and/or the smart-ring flags at step 216 to determine whether or not to answer the call. If the call

should be answered, test step 218 passes control to step 220. When the call is answered, the play and record message flags are checked at step 220, and decision step 222 transfers control to either the play message routine of FIGURE 6 or to 5 the record incoming call routine of FIGURE 7 based upon the settings of the control flag. A platform user may also set the flags after having an incoming call identified to the user based on the Caller I.D. The received Caller I.D. number may be looked up in the Caller I.D. table and the user notified of 10 the name associated with the Caller I.D., or if the I.D. number is not in the table, the user may be notified with the calling number.

If the call is not answered or if a message is not to be recorded or played after the second or fourth ring, control 15 passes to step 224 to scan for an incoming ring signal. When an incoming ring signal is detected, the processor checks the telephone port flags at step 226 to determine which telephones connected to the platform should be rung. Test step 228 determines if a ring parameter conflict exists, and if such a 20 conflict exists, the smart-ring parameter takes priority at step 230. The ring signal is generated at step 232 to the selected telephone(s). When no ring parameter conflict exists, the ring signal is also generated at step 232 to the selected telephone(s).

25 Next, inquiry step 234 determines if the telephone is in an off-hook condition. When an off-hook condition does not

exist, the incoming call ring count is incremented at step 236 for the present call. Inquiry step 238 determines if the call answer flag has been set, and if not, performs a test at step 240 to determine if the call ring count equals ten. If 5 the call ring count equals ten, control passes to the system access routine of FIGURE 16 to enable an outside caller to remotely access the system. If the call ring count does not equal ten or if the answer flag has not been set, a test is performed at step 244 to determine the existence of an incoming call or an off-hook condition. Control then passes 10 back to the executive routine of FIGURE 4.

Returning now to inquiry step 234, if the telephone is determined to be in an off-hook condition, the ring voltage to the telephone is discontinued, the smart-ring and I.D. port flags are reset and the audio path connected at step 242. The 15 telephone is tested for an on-hook condition at step 248 until an on-hook condition is detected. Control then returns to the executive routine of FIGURE 3.

Referring now to FIGURE 6, there is illustrated the 20 routine for playing messages to incoming calls. Once inquiry step 222 of FIGURE 5 determines a message is to be played, the message in progress flag is set at step 502. The phone is indicated at step 504 to have an off-hook condition at the 25 central office and a prerecorded outgoing message is played based upon the Caller I.D. and/or ring cadence. A test is

performed at step 506 to monitor for an interrupt condition of either a DTMF "0" digit or the spoken command "CONTROL FUNCTIONS." If an interrupt condition is detected, the outgoing message is interrupted and control passes to the system access routine of FIGURE 16. Otherwise, after the 5 prerecorded message has been played, the call is disconnected, an on-hook condition is indicated to the central office and the message in progress flag is reset at step 508. Control then returns to the executive routine of FIGURE 4 to monitor 10 for additional incoming calls or telephone off-hook conditions.

Referring now to FIGURE 7, there is illustrated the record incoming call routine. This routine records an incoming call routed to its control functions. If inquiry step 222 of FIGURE 5 indicates a call is to be recorded, the 15 recording in progress flag is set at step 602. Next, the platform notifies the central office of an off-hook condition, plays a prerecorded outgoing message based upon the Caller I.D. and/or ring cadence and records a message from the incoming call at step 604. Inquiry step 606 monitors for an 20 interrupt condition consisting either of a DTMF of "0" digit or the spoken command "CONTROL FUNCTIONS." If one of the interrupt conditions are detected, control passes to the system access routine of FIGURE 16. Otherwise, the recorded 25 message is stored at step 608 based upon the Caller I.D. and/or ring cadence. The system then resets the recording in

process flag, disconnects the call and provides an on-hook indication to the central office at step 610.

Referring now to FIGURE 8, there is illustrated the originating call/command handler routine. This routine 5 enables access of telephone functions from within the platform once the handset of a telephone connected to the platform has been placed in an off-hook condition. Once an off-hook condition is detected by inquiry step 104 of FIGURE 4, a dial tone is generated at step 304 to the user. This may be the 10 dial tone from the central office or an artificially generated dial tone. Inquiry step 308 tests for receipt of a DTMF digit. If a DTMF digit is detected, the dial tone is discontinued, and the provided DTMF digits are collected at step 316. Next, a check is performed at step 320 for any 15 incoming calls. If no incoming calls are detected, tests are performed at step 322 and 324 to determine if the message in progress or recording in progress flags are set.

If neither of these flags are set, the outgoing line is seized, and the collected DTMF digits are outpulsed at step 20 332. If an incoming call is detected, or the message in progress or recording in progress flags are set, a message is played at step 326 asking the user to hold. Test Step 328 monitors for disconnection of the incoming call, and seizes the outgoing line at step 332 once the incoming call is 25 disconnected. Once the outgoing line is seized, the DTMF

digits are outpulsed and the audio path is connected.

Step 334 monitors for an on-hook condition and passes control back to the executive routine of FIGURE 4 when an on-hook condition is detected.

5 If no DTMF digits are detected at step 308, inquiry step 310 tests for a speech command on the telephone line. When a speech command is detected, the dial tone is discontinued at step 314 and control passes to the spoken command control routine of FIGURE 9. When no speech commands are detected at step 310, inquiry step 312 monitors for an on-hook condition. If no on-hook condition exists, control returns to step 308 and the platform continues to monitor for DTMF digits or voice commands. When an on-hook condition is detected, the routine returns to the executive routine of

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15 FIGURE 4.

Referring now to FIGURE 9, there is illustrated the spoken command control routine. This routine enables a user to vocally select a variety of telephone services. The spoken command detected at step 310 of FIGURE 8 is retrieved at step 20 802. A variety of tests are performed at steps 804, 806, 808 and 810 to determine which spoken command has been received. If a "DIAL" command is detected at step 804, control passes to the spoken digit collection routine of FIGURE 10. If a "CALL" command is detected at step 806, control passes to the key word speed dialing routine of FIGURE 11. The detection of a

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" DIRECTORY" command at step 808 passes control to the speed dialing from user director routine of FIGURE 12. Finally, if a "SELECT" command is detected at step 810, the command is processed within the local branch of the system access routine 5 of FIGURE 16. If none of these voice commands are detected, an error condition exists and the "Error, please repeat" message is played to the caller or user at step 812. Control then returns to step 802 to monitor for the repeated spoken command.

10 Referring now to FIGURE 10, there is illustrated the spoken digit collection routine. This routine accepts a spoken digit string, representing a telephone number, from a user and forwards the number for dialing. A user is prompted at step 1002 with a "Phone number please" message to begin 15 collection of the spoken number string. Inquiry step 1004 determines if a spoken digit has been collected. If a digit has not been collected, inquiry step 1006 determines if a time-out period for collection of the digit has elapsed. Once the required time-out period elapses a "Please enter digit" 20 message plays at step 108 to prompt the user to enter or re-enter the required digit. Once step 104 determines a digit has been collected, a short beep is generated to the user at step 1010 to indicate the digit has been received and recognized. Inquiry step 1012 calculates if the previously 25 collected spoken digit was the last digit expected in the

string. If not, the digit is saved in a string buffer at step 1014 and control passes back to step 1004 to accept the next digit in the string.

Once the last digit of the numeric string has been
5 collected, the speaker-independent recognizer is engaged at
step 1016. Step 1018 monitors for the spoken command
"VERIFY." If the "VERIFY" command is not received, a message
instructing the user to repeat the "VERIFY" command is played
at step 1020. Once a "VERIFY" command is recognized, the
10 platform repeats the digit string to the user at step 1022.

Inquiry step 1024 monitors for the "STORE" voice command
and passes control to the key word speed dial number storage
routine of FIGURE 13 when the command is detected. If no
"STORE" voice command is detected, step 1026 monitors for a
15 "SEND" voice command. Once a "SEND" voice command is
detected, control passes to step 320 of the originating
call/command handler routine of Figure 8 to output the
collected digit string. Otherwise, the message "Error, please
repeat" prompts the user at step 1028 to provide the "STORE"
20 or "SEND" command.

Referring now to FIGURE 11, there is illustrated the key
word speed dialing routine. This routine enables a user to
access a previously stored telephone number in response to a
spoken speaker-independent key word. At step 1102, the
25 platform plays a message "Calling," prompting the user to

begin the key word dialing sequence. The speaker-independent recognizer is engaged at step 1104 to obtain a user response. The speaker-independent recognizer monitors at step 1106 for the spoken command "MEMORY." If the "MEMORY" command is not detected, the user must speak a valid key word at step 1108 to speed dial the associated number. Examples of valid key words include "BANK", "ACCOUNT BALANCE", "OFFICE", "TIME", "SECRETARY", "FRIEND", "WORK" AND "INFORMATION." This list is not intended to be exhaustive and any number of key words may be used. Inquiry step 1110 determines if a valid key word has been spoken. If the platform, does not recognize the key word, step 112 prompts the user with the message "Error, please repeat." When the key word is accepted as valid, a "Calling" message is played at step 114.

If the command "MEMORY" is detected at step 1106, the user is prompted with message "Which memory" and the speaker-independent recognizer is engaged. At inquiry step 1130 the speaker-independent recognizer determines if a two-digit memory location number has been spoken by the user. If not, the platform performs a test check at step 1132 to determine if the time out period has elapsed. Once the time out period elapses, the user is prompted at step 1134 with a "Please enter next digit" message. Once the 2-digit memory location number is collected, the telephone number associated with the memory location number is recalled at step 1136 from FLASH

memory 30. The user is then notified at step 114 with a "Calling" message.

Once a key word or memory call location is collected, the speaker-independent voice recognizer is engaged at step 1116

5 The speaker-independent voice recognizer monitors at inquiry step 1118 for a spoken command "VERIFY", and when the "VERIFY" command is detected, the stored number associated with the key word or memory location is repeated to the user at step 1122.

At inquiry step 1124, the speaker-independent recognizer monitors for a spoken command "CLEAR" indicating that the user desires to clear the number retrieved and start again. If so, the taped message "Ready" is played at step 1126 and Control returns to step 1108. If neither the "CLEAR" command nor the "VERIFY" command are recognized, inquiry step 1120 determines if the voice command "SEND" has been spoken. If not, the user is prompted at step 1138 with an "Error, please repeat" message and control passes back to step 1116. Otherwise, control passes to step 320 of the originating call/command handler routine of FIGURE 8 to call the selected number.

20 Referring now to FIGURE 12, there is illustrated the routine for speed dialing from a pregenerated user directory. This routine enables a user to speed dial a number from a preexisting directory using speaker-dependent names. The user is prompted at step 1202 with a "Name please" message. Step 25 1202 also engages the speaker-dependent recognizer. At

inquiry step 1204, a determination is made if a spoken name has been collected and recognized by the speaker-dependent recognizer. If no name has been recognized, step 1220 determines if the timeout period has elapsed, and if not, 5 prompts the user at step 1222 with an "Error, please repeat" message. Once the timeout period elapses, the user is further prompted with the "Name please" message of step 1202.

Once the name is collected at step 1204, the telephone number associated with the name is recalled at step 1206 from 10 FLASH memory 30. The stored number is played to the user at step 1208 after which the user is prompted with a "Correct" message. Inquiry step 1210 then monitors for a spoken command "CORRECT." Upon detection of the "CORRECT" command, the user is provided with a "Dialing" message and control passes to 15 step 320 of the originating call/command handler routine of FIGURE 8. When the "CORRECT" command is not received, control returns to step 1202 to have the user repeat the name.

Referring now to FIGURE 13, there is illustrated the key word speed dial number storage routine. This routine enables 20 a user to associate a selected speaker-independent key word with a telephone number and have the number and associated key word stored in memory. Initially, the user is prompted at step 1402 with a "Storing" message as the digit string from FIGURE 10 is saved, and the speaker-independent recognizer is 25 engaged. The speaker-independent speech recognizer monitors

at step 1404 for the spoken command "MEMORY." This enables the user to stop the number at a location identified by a two-digit memory code. If the "MEMORY" command is received, control passes to the memory speed dial number storage routine of FIGURE 14. Otherwise, the spoken independent recognizer monitors at step 1406 for a spoken command "DIRECTORY." If the "DIRECTORY" command is detected, control passes to the director speed dial number storage routine of FIGURE 15, and the user may store a directory name or a number associated with a directory name.

When neither a "MEMORY" nor "VOICE" command is detected, the recognizer monitors at step 1410 for entry of a new speaker-independent key word. When no new key word is detected, an "Error, please repeat" message prompts the user to enter a spoken command or key word at step 1420 and control returns to inquiry step 1404. When a new key word is collected, the user is prompted at step 1412 with a "Storing (key word) correct" message. Inquiry step 1414 then determines if the received key word was correct. If not, a "Location, please" message prompts the user at step 1418 to repeat the key word and control returns to step 1410. Once the correct key word is entered, the system advises the user at step 1416 with a "Storing" message, and the number and associated key word are stored in FLASH memory 30. Control then passes to step 304 of the originating call/command handler routine of FIGURE 8.

Referring now to FIGURE 14, there is illustrated the memory speed dial number storage routine. This routine allows the user to store a particular number in a selected memory location having an associated two-digit memory code. The user 5 is prompted at step 1502 with a "Which memory?" message and the speaker-independent recognizer is engaged. At inquiry step 1504, the speaker-independent voice recognizer monitors for receipt and recognition of a 2-digit memory location number. If both digits have not been received, the routine 10 continues to cycle through step 1506 until a timeout period has elapsed. If both digits have not been received, and the timeout period elapses, the user is prompted at step 1508 with a "Please enter next digit" message.

Once both digits for the memory location code are received and recognized, the user receives a "Storing memory (two-digits), correct?" message, indicating the two-digit memory location number the system has collected. If the digits are incorrect, the speaker-independent recognizer is reengaged, the user is prompted at step 1512 with a "Location 15 please" message and control returns to step 1504 to enable the user to reenter the memory location digits. If the received memory location number is correct, a test is performed at step 1516 to determine if the storage memory is full. If not, the user receives a "Storing" message and the number is stored 20 in FLASH memory at step 1518 at the indicated memory location 25

number. System control then returns to step 304 of the originating call command handler routine of FIGURE 8.

If step 1516 determines the FLASH memory locator is full, the user is provided with a "Memory full, erase?" message at 5 step 1520. The speaker-independent recognizer then monitors at step 1522 for the voice command "ERASE." If no "ERASE" command is received, the procedure ends and control passes to step 304 of the originating call/command handler routine of FIGURE 8. If the "ERASE" command is detected, the user is prompted at step 1524 to confirm the erase instruction, and 10 the voice recognizer again monitors at step 1526 for the voice command "ERASE." If the "ERASE" command is confirmed, the identified location entry is erased at step 1528.

Referring now to FIGURE 15, there is illustrated the 15 directory speed dial number storage routine. This routine stores a number in a personal directory responsive to speaker-dependent directory names. The personal directory will be responsive only to commands from a particular user.

Initially, the routine checks at step 1604 to determine if the 20 selected number is already stored in FLASH memory. If the number is presently stored, the user is prompted with a "Re-enroll" message at step 1616. The speaker-independent speech recognizer then monitors at step 1618 to determine if the user wishes to re-enroll the directory name. If the user 25 wishes to re-enroll the directory name, the user is prompted

at step 1610 for a name to be associated with the number. If the directory name is not to be re-enrolled, an "Erase" message prompts the user and the voice recognizer monitor is engaged at step 1620. Inquiry step 1622 determines if the user wishes to erase the directory number. If not, control 5 passes to step 304 of FIGURE 8. If the directory number is to be erased, the associated number is erased and two beeps notify the user of the erasure at step 1624. Command control then returns to step 304 of FIGURE 8.

10 If inquiry step 1604 determines the number is not presently enrolled in memory, the user is prompted with an "Enroll" message and engages the speaker-independent recognizer. A test at step 1608 determines if the number should be enrolled. If the number is not to be enrolled, control passes to step 304 of the originating call/command 15 handler routine of FIGURE 8. Otherwise, the user is prompted at step 1610 for a name to be associated with the number and the speaker-dependent recognizer is engaged. The user speaks the name to be associated with the number three times at step 20 1612 to program the speaker-dependent template. The new directory name and associated telephone number are stored at step 1614 in FLASH memory, and the user is notified of this by two beeps. Control then passes to step 304 of the originating call/command handler routine of FIGURE 8.

25 Referring now to FIGURE 16, there is illustrated the system access routine. The system access routine enables

access to the platform either remotely beginning at point 700 or locally beginning at point 1300. The access pathway depends on whether a caller from an outside line is accessing the platform, or the caller is using one of the local platform 5 telephones. When the platform is accessed remotely, the outgoing message being played is discontinued and the caller is provided with a "Ready" message at step 702. The system then waits for a command trigger and sets the remote access flag. The user enters at step 704 a four-digit speaker 10 verification code to access the platform. A test performed at step 706 determines if the verification code is valid. If not, the caller is notified of the invalidity of the code, the call is disconnected and flags are reset at step 1316.

When a valid code is received, a "Command please" message 15 prompts the user at step 708, and the platform waits for a command trigger. At inquiry step 710, the platform monitors for either the voice command "MESSAGES" or a DTMF "1" digit. If one of these triggers are detected, the system determines at inquiry step 1318 if any messages are available. When no 20 messages are available, control returns to step 708 to await additional command triggers. If messages exist, control passes to message playback routine of FIGURE 17. Inquiry 712 tests for either the voice command "FUNCTIONS" or a DTMF "2" digit. If either of these triggers are detected, control 25 passes to the peripheral control routine of FIGURE 18.

Otherwise the system generates two beeps to the remote caller at step 714 and control passes back to step 708.

If a user accesses the system locally through point 1300, the user is initially prompted with a "Command please" message 5 at step 1302 and awaits a command trigger. Inquiry step 1304 determines if the voice command "MESSAGES" is spoken and, if so, the user is prompted at step 1310 to enter a verification code. The user enters a four digit speaker verification code at step 1312, and the validity of the code is tested at 10 inquiry step 1314. If the verification code is valid, control passes to step 1318 to provide the user access to his messages as previously described. If the verification code is invalid, control passes to step 1316 and the user is notified of the 15 invalid code and disconnected from the platform. If no "MESSAGE" command is received, inquiry step 1306 monitors for a voice command "FUNCTIONS" and passes control to the peripheral control routine if the "FUNCTIONS" command is detected. Otherwise, two beeps are generated to the user at step 1308 and control passes back to step 1302 to monitor for 20 command triggers.

Referring now to FIGURE 17, there is illustrated the message playback routine. This routine enables a user to review recorded messages. Messages are retrieved at step 1702 based upon the speaker verification number provided by the 25 user, and the messages associated with the identified speaker

are played. Inquiry step 1704 monitors for receipt of DTMF digits or any spoken commands during playing of the messages. If neither is detected, step 1722 monitors for the end of the selected messages and continues playback at step 1720 until 5 the end of the messages is detected. Once the end of the messages is reached, the user is prompted at step 1724 with a "Clear Messages" message. Inquiry step 1726 determines if the messages are to be cleared. If the messages are not to be cleared, control passes to step 1730 wherein the call is 10 disconnected if the remote access flag is set. If the messages are to be cleared, they are erased at step 1728. Control then returns to the executive routine of FIGURE 4.

15 If a DTMF digit or spoken command is detected at step 1704, inquiry step 1706 determines if the received command is either a DTMF "3" digit or a spoken command "SKIP." If so, the system proceeds to the next recorded message at step 1704. If a DTMF "4" digit or "BACK" command is detected at inquiry step 1708, the current message is repeated at step 1716. If either a DTMF "5" digit or "DELETE" 20 command is detected at step 1710, the current message is erased at step 1718. If none of the above-described triggers are detected, the input is ignored at step 1712 and control passes back to step 1722.

25 Referring now to FIGURE 18, there is illustrated the peripheral control routine. The peripheral control routine

enables a user to access and control a variety of systems within a home or business through the telephone system using a series of voice commands. When the peripheral control routine is accessed, the user is initially prompted at step 1824 with 5 a "Ready" message. The system then monitors for the spoken command "ANSWER" at step 1802. If the "ANSWER" command is received, the telephone answering device functions are turned on or off at step 1814. If no "ANSWER" spoken command is received, the system type is checked at step 1804. Test 10 step 1806 monitors for the command enhanced. If not detected, control returns to the prompting step 824. If the enhanced command is received, inquiry steps 1808, 1810 and 1812 monitor for the commands lights, thermostat or alarm respectively. If none of these spoken commands are detected, control returns to 15 prompting step 1824.

If a "LIGHTS" command is received, the lights may be dimmed or turned on or off at step 1816 using spoken commands. If the "THERMOSTAT" command is received, the user may check and change the thermostat settings using spoken 20 commands at step 1818. If the "ALARM" command is received, the user may turn on or off the perimeter alarm system using spoken commands at step 1820. Once access of the peripheral devices is complete, control passes to step 1824 wherein the call is disconnected, remote access flag is set and all other 25 flags cleared at step 1822 wherein all flags are reset and the

call is disconnected. The system then returns to the executive routine described in FIGURE 4.

While the above description of FIGURES 4 through 18 have been given with respect to the use of vocal commands to enable 5 access to the variety of telephone services made available to user by the intelligent call platform, the above described platform would function equally well using pushbutton entry of DTMF digit commands as opposed to vocal commands.

Alternatively, both voice and/or vocal commands could be 10 utilized.

It should be appreciated by those skilled in the art that the specific embodiments disclosed above may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present 15 invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

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